

Digenean Trematodes from Tetraodontiform Fishes from Japanese and Adjacent Waters

Masaaki Machida and Toshiaki Kuramochi

Department of Zoology, National Science Museum,
3–23–1 Hyakunincho, Shinjuku-ku, Tokyo, 169–0073 Japan

Abstract Twenty-eight species of digeneans are recorded from tetraodontiform fishes of Japanese and adjacent waters. Five new species and two new genera are named: *Sacculoacetabulum ohjibah* gen. & sp. nov. (Zoogonidae), *Deretrema (Spino-deretrema) triodontis* sp. nov. (Zoogonidae) and *Neomegacreadium okinawanum* gen. & sp. nov. (Schistorchiidae) from *Triodon macropterus*; *Lobatocreadium magnum* sp. nov. (Lepocreadiidae) from *Arothron hispidus*; and *Lobatocreadium ryukyuense* sp. nov. (Lepocreadiidae) from *Ostracion cubicus*. *Sacculoacetabulum* is characterized by a balloon-shaped acetabulum, the orifice of which is narrow, located at the midanterior edge and surrounded by powerful muscular sphincter. *Neomegacreadium* is distinguished from the related *Megacreadium* by having a mouth enclosed by a broad muscular lobe anteriorly and muscular bundle lateroposteriorly, a uroproct, ten or occasionally 11 or 12 testes, vitellaria extending to the posterior level of the oral sucker. The following taxonomic changes are proposed: *Maculifer chilomycteri* Yamaguti, 1959 is synonymous with *Heterolebes maculosus* Ozaki, 1935; *Aponurus vitellograndis* Layman, 1930 and *A. rhinoplagusiae* Yamaguti, 1934 are synonymous with *A. laguncula* Looss, 1907.

Key words: Digenean trematodes, tetraodontiform fishes, new genera, new species, new synonymy, Japanese waters.

Descriptions of digenean trematodes from unicornfishes (Machida & Uchida, 1990), sea chubs (Machida, 1980, 1993) and mullets (Machida, 1996) have been made from Japanese and adjacent waters. This paper sets out to describe the digeneans of tetraodontiform fishes from the same waters.

Digeneans were collected from fresh fishes, washed in saline, fixed in AFA or 70% ethanol under slight pressure, stained with Heidenhain's hematoxylin or alum carmine and mounted in balsam. The specimens are deposited in the National Science Museum, Tokyo (NSMT). Measurements are given in millimeters unless otherwise stated.

We are especially indebted to the following fishermen's cooperative associations for providing facilities for our field research: Kushimoto, Wakayama Prefecture; Fukaura, Ehime Prefecture; Takojima, Ishikawa Prefecture; Nishidomariwan, Nagasaki Prefecture; Nishinoomote and Setouchi, Kagoshima Prefecture; and Nago, Okinawa Prefecture. Thanks are also due to Director Sh. Kamegai, Meguro Parasitologi-

cal Museum (MPM), for the loan of type specimens of *Hypocreadium patellare*.

Cephaloporidae

1. *Alloplectognathotrema tsushimaense* (Kamegai, 1970)

Material. From intestine of *Aluterus scriptus* (Monacanthidae), Nago, Okinawa Prefecture, Japan, 13-V-1983 (NSMT-PI 2756); and intestine of *A. scriptus*, Nago, 21-V-1983 (NSMT-PI 2792).

Remarks. Kamegai (1970) described this species based on a single specimen from *Navodon modestus* (= *Thamnaconus m.*) from the Sea of Japan and created the new subgenus *Alloplectognathotrema* for it in the genus *Plectognathotrema*. Yamaguti (1971) raised the subgenus *Alloplectognathotrema* to the rank of the genus to include *A. tsushimaense*.

Most of our specimens are not gravid without eggs. Four specimens with a small number of eggs are: Body 1.36–1.70 long by 1.04–1.30 wide. Oral sucker 0.20–0.25×0.22–0.25. Prepharynx 0.02–0.05 long. Pharynx 0.10–0.13×0.15–0.16. Esophagus 0.21–0.47 long. Acetabulum 0.69–0.90×0.85–1.07. Right testis 0.23–0.32×0.17–0.33. Left testis 0.26–0.34×0.19–0.23. Cirrus sac 0.46–0.51×0.13–0.16. Ovary 0.17–0.25×0.19–0.23. Vitelline follicles 8–10 on right and 11–13 on left. Eggs 20–23×12–16 μ m. Largest specimen without eggs is 2.03 long by 1.55 wide.

The worms are plump and therefore the internal organs vary their positions depending on fixation. For example, the caeca terminate from anterior to middle acetabular level, the testes lie from anterior to the acetabulum to near the posterior end of the body, etc.

This species closely resembles *Plectognathotrema cephalopore* Layman, 1930 from *Cantherines modestus* (= *Thamnaconus m.*) from the Sea of Japan except that the former has rosette-shaped adhesive organs in the acetabulum and two-chambered seminal vesicle. Layman's description was so brief that he did not refer to these features.

Opistholebetidae

2. *Heterolebes maculosus* Ozaki, 1935

Material. From intestine of *Diodon holocanthus* (Diodontidae), Fukaura, Ehime Prefecture, Japan, 19-V-1972 (NSMT-PI 948a); intestine of *D. holocanthus*, Tanegashima, Kagoshima Prefecture, Japan, 17-XI-1974 (NSMT-PI 1716a); and intestine of *D. hystrix*, Nago, Okinawa Prefecture, Japan, 6-III-1996 (NSMT-PI 4853).

Remarks. This species was found associated with *Opistholebes*, *O. cotylophorus* and *O. elongatus*, in *Diodon holocanthus*.

Ozaki (1935) collected this species from *D. holocanthus* and stated the acetabulum to have "remnant of adhesive disc but not remarkable." Later he (1937) rewrote

the acetabulum to possess strong acetabulo-pharyngeal and radiating muscles. Yamaguti (1959) described *Maculifer chilomycteri* from *Chilomycterus affinis* (= *C. reticulatus*, Diodontidae) as a new species which has a normal-shaped acetabulum. This species closely resembles *H. maculosus*. Somehow, he did not compare it with the related species. Yamaguti (1970) examined his Hawaiian material of *H. maculosus* and pointed out that the acetabulum has radial muscle bundles but does not have such a circumacetabular fold as that of *Opistholebes cotylophorus* Ozaki, 1935. In the diagnosis of the genus *Heterolebes*, however, Yamaguti (1971) incorrectly described the acetabulum as being surrounded by circular fold, and did not agree with Manter and Pritchard (1962) that *Maculifer chilomycteri* should be transferred to the genus *Heterolebes*. Originally *Heterolebes* does not have a circumacetabular fold. Only difference between *M. chilomycteri* and *H. maculosus* is the location of the ovary, that is, it is situated on the anteromedial of the right testis in the former, whereas closely anterior to the right testis in the latter. Of our four specimens, only one is gravid (NSMT-PI 948a), with the testes lying symmetrically near the posterior extremity and the ovary just anterior to the right testis. We consider *M. chilomycteri* a synonym of *H. maculosus*.

3. *Maculifer pacificus* Yamaguti, 1938

Material. From rectum of *Takifugu pardalis* (Tetraodontidae), Fukaura, Ehime Prefecture, Japan, 25-V-1972 (NSMT-PI 1003); and rectum of *T. porphyreus*, Tushima, Nagasaki Prefecture, Japan, 17-VII-1973 (NSMT-PI 1538).

Remarks. Yamaguti (1938) distinguished *M. pacificus* from *M. japonicus* Layman, 1930 by the eggs measuring 57 to 75 by 36 to 42 μm as against 78 to 91 by 42 to 51 μm .

4. *Opistholebes cotylophorus* Ozaki, 1935

Material. From intestine of *Diodon holocanthus* (Diodontidae), Fukaura, Ehime Prefecture, Japan, 19-V-1972 (NSMT-PI 948b); and intestine of *D. holocanthus*, Ogasawara, Japan, 2-VII-1976 (NSMT-PI 1975).

5. *Opistholebes elongatus* Ozaki, 1937

Material. From intestine of *Diodon holocanthus* (Diodontidae), Fukaura, Ehime Prefecture, Japan, 19-V-1972 (NSMT-PI 948c); intestine of *D. holocanthus*, Tanegashima, Kagoshima Prefecture, Japan, 16-XI-1974 (NSMT-PI 1713); intestine of *D. holocanthus*, Tanegashima, 17-XI-1974 (NSMT-PI 1716b); intestine of *Chilomycterus reticulatus* (Diodontidae), Kushimoto, Wakayama Prefecture, Japan, 27-X-1979 (NSMT-PI 2274a); intestine of *Diodon hystrix*, Nago, Okinawa Prefecture, Japan,

6–III–1996 (NSMT-PI 4852); and rectum of *D. hystrix*, Nago, 6–III–1996 (NSMT-PI 4854).

6. *Pseudoheterolebes chilomycteri* Yamaguti, 1959

Material. From intestine of *Chilomycterus reticulatus* (Diodontidae), Kushimoto, Wakayama Prefecture, Japan, 27–X–1979 (NSMT-PI 2274b).

Remarks. The worm is plump and therefore the organs change their positions depending on fixation. In our specimens, the acetabulum is located near the center of the posterior half of the body. The testes are almost symmetrical, overlapping the acetabulum in part, from the anterior to the posterior border of the acetabulum. The ovary is slightly dextral, between anterior border and posterior level of the acetabulum.

We consider the genus *Pseudoheterolebes* to be valid because the body is frilled at the posterior end.

Accacoeliidae

7. *Tetrochetus aluterae* (Hanson, 1955)

Material. From intestine of *Aluterus monoceros* (Monacanthidae), Fukaura, Ehime Prefecture, Japan, 20–V–1972 (NSMT-PI 951); intestine of *A. monoceros*, Fukaura, 24–V–1972 (NSMT-PI 992); intestine of *A. monoceros*, Fukaura, 17–XII–1972 (NSMT-PI 1117); intestine of *A. monoceros*, Tanegashima, Kagoshima Prefecture, Japan, 9–XI–1974 (NSMT-PI 1686); rectum of *Diodon holacanthus* (Diodontidae), Tanegashima, 16–XI–1974 (NSMT-PI 1714); intestine of *A. monoceros*, Takojima, Ishikawa Prefecture, Japan, 6–X–1984 (NSMT-PI 3040); intestine of *A. scriptus*, Nago, Okinawa Prefecture, Japan, 27–V–1992 (NSMT-PI 4301); and intestine of *A. scriptus*, Nago, 9–III–1996 (NSMT-PI 4888).

Remarks. Twelve specimens from *Aluterus monoceros* and *A. scriptus* are: Body 4.35–8.75 long by 0.82–1.15 wide. Oral sucker 0.30–0.42×0.31–0.44. Acetabulum 0.42–0.61×0.34–0.51. Sucker ratio based on length 1 : 1.2–1.5. Forebody 13–24% of body length. Anterior testis 0.18–0.57×0.20–0.56 and posterior testis 0.18–0.70×0.22–0.57. Ovary 0.14–0.45×0.18–0.57. Considerable variation exists in the size of testes and ovary. Postovarian space 28–41% of body length. Eggs 25–35×16–20 μ m. Our specimens agree with the description of *T. aluterae* (Hanson, 1955; Yamaguti, 1970) with the exception of the body being slightly wider.

Four specimens from *Diodon holacanthus* are: Body 6.50–9.75 long by 1.67–1.93 wide. Oral sucker 0.29–0.47×0.38–0.43. Acetabulum 0.65–0.77×0.60–0.77. Sucker ratio based on length 1 : 1.6–2.2. Forebody 18–22% of body length. Anterior testis 0.51–0.79×0.68–1.06 and posterior testis 0.52–0.91×0.76–0.95. Ovary 0.45–0.65×0.59–0.75. Postovarian space 31–38% of body length. Eggs 24–30×16–21 μ m.

Compared with *T. aluterae*, our specimens from *D. holacanthus* have wider body and larger acetabulum, testes and ovary. We are provisionally placing these specimens in *T. aluterae* and additional collections may show the specimens to be placed in the proper species.

Fellodistomidae

8. *Discogasteroides ostracii* (Yamaguti, 1934)

Material. From intestine of *Ostracion immaculatus* (Ostraciidae), Fukaura, Ehime Prefecture, Japan, 25-V-1972 (NSMT-PI 1002); intestine of *O. immaculatus*, Tsushima, Nagasaki Prefecture, Japan, 12-VII-1973 (NSMT-PI 1510); intestine of *O. cubicus*, Tanegashima, Kagoshima Prefecture, Japan, 16-XI-1974 (NSMT-PI 1712); intestine of *O. cubicus*, Tanegashima, 20-XI-1974 (NSMT-PI 1737); intestine of *O. cubicus*, Tanegashima, 23-XI-1974 (NSMT-PI 1746); intestine of *O. cubicus*, Tanegashima, 24-XI-1974 (NSMT-PI 1748); intestine of *O. immaculatus*, Kushimoto, Wakayama Prefecture, Japan, 21-X-1979 (NSMT-PI 2229); and intestine of *O. immaculatus*, Kushimoto, 25-X-1979 (NSMT-PI 2259).

9. *Lintonium laymani* Skrjabin & Koval, 1957

Material. From stomach of *Aluterus monoceros* (Monacanthidae), Fukaura, Ehime Prefecture, Japan, 24-V-1972 (NSMT-PI 998); stomach of *Thamnaconus modestus*, Takojima, Ishikawa Prefecture, Japan, 5-X-1984 (NSMT-PI 3033); stomach of *T. modestus*, Takojima, 6-V-1986 (NSMT-PI 3236); and stomach of *T. modestus*, Takojima, 12-V-1986 (NSMT-PI 3265).

Remarks. Three fully gravid specimens from *Thamnaconus modestus* are: Body plump, 6.10–6.95 long by 3.30–3.70 wide. Oral sucker 0.80–0.87×0.88–0.93. Pharynx 0.30–0.35×0.35–0.42. Acetabulum 1.75–2.15×1.90–2.30, occupies 55–64% of body width. Sucker ratio 1:2.2–2.5. Forebody 41–47% of body length. Testes 0.40–0.73×0.50–0.85. Posttesticular space 29–33% of body length. Ovary 0.40–0.45×0.45–0.65. Eggs thick-shelled, 37–46×23–28 μm .

Three specimens from *Aluterus monoceros* are: Body elongated, 6.93–8.40 long by 2.28–2.75 wide. Oral sucker 0.68–0.85×0.78–0.90. Pharynx 0.30–0.33×0.35–0.46. Acetabulum 1.28–1.38×1.45–1.53, occupies 54–67% of body width. Sucker ratio 1:1.6–2.0. Forebody 45–47% of body length. Testes 0.55–0.83×0.43–0.85. Posttesticular space 30–33% of body length. Ovary 0.40–0.48×0.40–0.43. Eggs rather thick-shelled, 35–45×19–26 μm .

Layman (1930) reported the specimens from *Cantherhines modestus* (= *Thamnaconus m.*) in the Sea of Japan as *Steringotrema pulchrum*. Skrjabin and Koval (1957) recognized *Lintonium laymani* as a new designation for *S. pulchrum* of Layman (1930).

Yamaguti (1934) described the specimens from *Monacanthus cirrhifer* (= *Stephanolepis c.*) and *Cantherhines unicornu* in Japan as *L. vibex*. Manter and Pritchard (1962) stated that the relative size of the acetabulum in Yamaguti's specimens was suggestive of *L. laymani* even though the eggs were slightly larger.

Machida (1971) also reported *L. vibex* from *Navodon modestus* (= *Thamnaconus m.*) and *Stephanolepis cirrhifer* in the Sea of Japan. Stunkard (1978) mentioned that the specimens described by Yamaguti (1934) and Machida (1971) were recognized as *L. laymani*.

Our specimens from *Thamnaconus modestus* agree fairly well with the diagnoses of *L. laymani* given by Skrjabin and Koval (1957) and Manter and Pritchard (1962). In our specimens, however, the relative size of acetabulum to body width considerably varies and the eggs are larger.

Our specimens from *Aluterus monoceros* agree with the diagnosis of *L. vibex* by Manter and Pritchard (1962) in the sucker ratio, and caeca and vitellaria not reaching the posterior end of the body, but cannot be distinguished from *L. laymani* in other respects. It is not certain whether the specimens from *Thamnaconus modestus* are the same as those from *Aluterus monoceros*. We are tentatively placing our specimens in *L. laymani*, so when additional material is examined, they can be placed in the proper species.

10. *Pseudodiscogasteroides aluteri* (Machida, 1972)

Material. From intestine of *Aluterus scriptus* (Monacanthidae), Ogasawara, Japan, 9–VII–1976 (NSMT-PI 2006).

Remarks. Machida (1972) placed this species in the genus *Paradiscogaster*. Bray (1984) stated that this species might be transferred to the genus *Pseudodiscogasteroides*. Only difference between *Paradiscogaster* and *Pseudodiscogasteroides* seems to be that the vitellaria in the former lie in zone of caecal ends, whereas in the latter they extend from the level of oral sucker or pharynx to the caecal ends.

Zoogonidae

Sacculoacetabulum gen. nov.

Zoogonidae. Lepidophyllinae. Body pyriform, spined. Oral sucker subterminal; prepharynx absent; pharynx small; esophagus short; caeca reaching midlevel of testes. Acetabulum in middle third of body, large, balloon-shaped, with narrow orifice which is located at the midanterior edge and surrounded by strong sphincter. Testes symmetrical, postacetabular. Cirrus sac claviform, extending to midacetabular level or more posteriorly, containing bipartite seminal vesicle, prostatic vesicle and eversible cirrus. Genital pore on right body margin at level of caecal bifurcation. Ovary median, dorsal to posterior region of acetabulum. Seminal receptacle and Laurer's

canal present. Vitellaria 8–13 large follicles on each side, from midacetabular to midtesticular level. Uterus in hindbody; metraterm well-developed. Excretory vesicle not observed. Intestinal parasites of marine teleosts.

Type species: *Sacculoacetabulum ohjibah* sp. nov.

11. *Sacculoacetabulum ohjibah* sp. nov.

(Figs. 1–3)

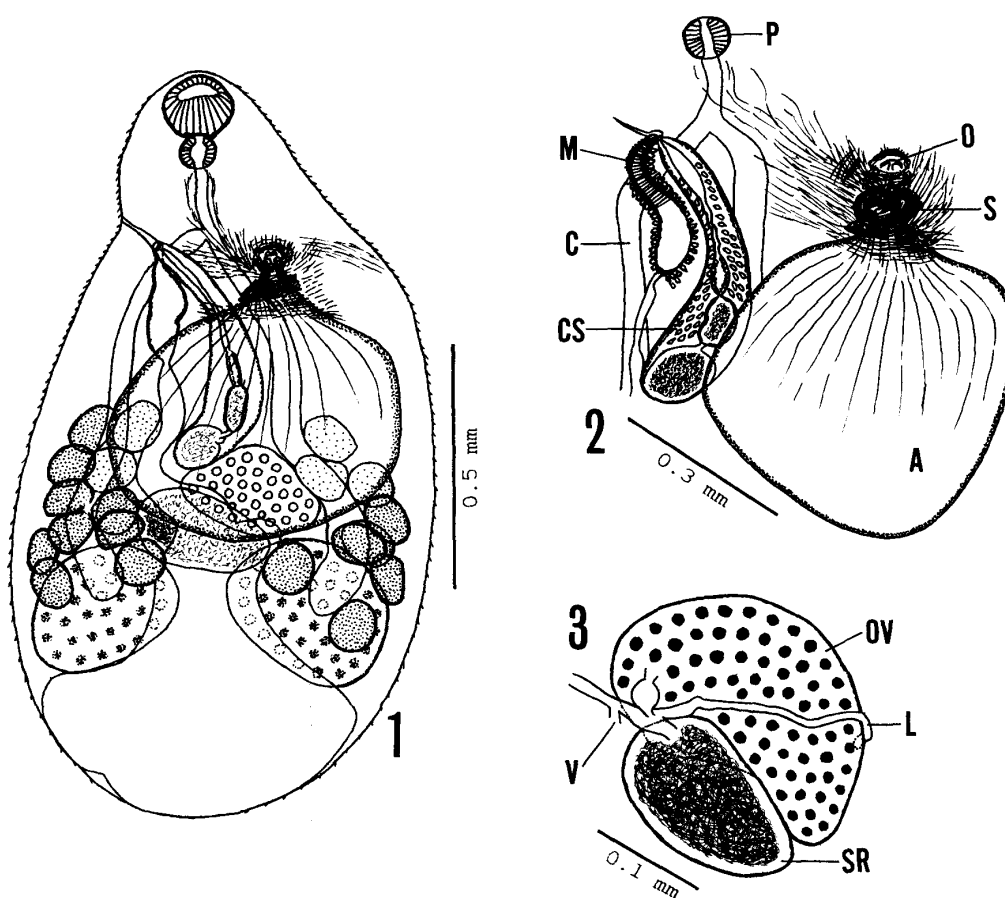
Material. Ten specimens from intestine of *Triodon macropterus* (Triodontidae), Nago, Okinawa Prefecture, Japan, 28–XI–1996 (NSMT-PI 4972, holotype and 9 paratypes).

Description. Based on 10 specimens. Body pyriform, 1.18–1.85 long by 0.71–1.05 wide at postacetabular level. Tegument with fine spines. Oral sucker spherical, subterminal, $0.10\text{--}0.16 \times 0.12\text{--}0.18$; prepharynx absent; pharynx globular, $0.06\text{--}0.09 \times 0.06\text{--}0.11$; esophagus short, 0.07–0.14 long, bifurcating midway between suckers; caeca extending midlevel of testes. Acetabulum $0.45\text{--}0.78 \times 0.42\text{--}0.78$, balloon-shaped with narrow orifice which is located at the midanterior edge and surrounded by strong muscular sphincter. The worm draws the host intestinal villi into the acetabular lumen, and tightly holds the villi by the sphincter. Sucker ratio 1 : 1.4–2.2. Forebody 38–50% of body length.

Testes spherical to ovoid, right testis $0.25\text{--}0.33 \times 0.22\text{--}0.48$ and left testis $0.23\text{--}0.38 \times 0.30\text{--}0.41$, symmetrical, just behind middle of hindbody. Posttesticular space 15–22% of body length. Cirrus sac claviform, $0.30\text{--}0.67 \times 0.09\text{--}0.14$, terminating posteriorly at midacetabular level or slightly beyond it, containing bipartite seminal vesicle whose proximal vesicle thin-walled and distal vesicle thick-walled, oval to tubular prostatic vesicle, and slender eversible cirrus. Genital pore on right body margin at level of caecal bifurcation.

Ovary ovoid, $0.11\text{--}0.27 \times 0.20\text{--}0.34$, median, dorsal to posterior region of acetabulum, in contact with posterior edge of cirrus sac. Seminal receptacle $0.12\text{--}0.19 \times 0.18\text{--}0.29$, just posterior to partially overlapping ovary. Laurer's canal opening dorsally in zone of ovary. Vitelline follicles large, 8–13 on right, 8–11 on left, from midacetabular to midtesticular level. Uterus filling available space of hindbody. Metraterm well-developed, near $2/3$ as long as cirrus sac. Eggs $20\text{--}26 \times 12\text{--}16\text{ }\mu\text{m}$. Excretory pore terminal, vesicle not observed.

Remarks. The genus *Sacculoacetabulum* is characterized by having a unique acetabulum and two-chambered internal seminal vesicle. The acetabulum is like a balloon in shape, with a narrow orifice which is located at the midanterior edge and surrounded by the well-developed muscular sphincter. The other morphological features, such as the caeca reaching to the testes, the testes arranged symmetrical in the anterior hindbody, the large cirrus sac extending well to the acetabulum, and the distribution of vitellaria are like those of the lepidophylline *Proctophantastes*. The name



Figs. 1–3. *Sacculoacetabulum ohjibah* gen. & sp. nov. — 1. Entire worm, ventral view (NSMT-PI 4972, holotype). 2. Acetabulum and terminal genitalia, ventral view. 3. Ovarian complex, lateral view. A, acetabulum; C, caecum; CS, cirrus sac; L, Laurer's canal; M, metraterm; O, orifice of acetabulum; OV, ovary; P, pharynx; S, sphincter; SR, seminal receptacle. V, vitelline duct (omitted).

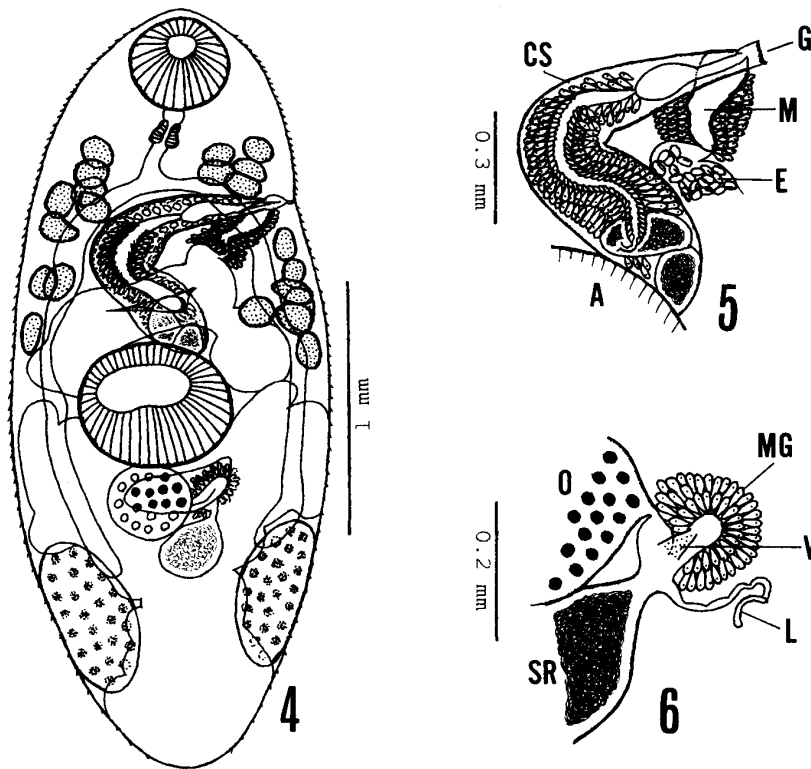
ohjibah is from the Japanese local name of the host.

12. *Deretrema (Spinoderetrema) triodontis* sp. nov.

(Figs. 4–6)

Material. Six specimens from rectum of *Triodon macropterus* (Triodontidae), Nago, Okinawa Prefecture, Japan, 28–XI–1996 (NSMT-PI 4974, holotype and 5 paratypes).

Description. Based on 6 specimens. Body cylindrical, 2.53–3.10 long by 1.17–1.23 wide at postacetabular level. Tegument with fine spines. Oral sucker subterminal, $0.33\text{--}0.35 \times 0.36\text{--}0.38$; prepharynx very short, 0.06–0.11 long; pharynx $0.09\text{--}0.11 \times 0.10\text{--}0.14$; esophagus short, 0.08–0.19 long, bifurcating anterior fourth between suckers; caeca ending in anterotesticular region. Acetabulum $0.50\text{--}0.57 \times 0.58\text{--}$



Figs. 4–6. *Deretrema* (*Spinoderetrema*) *triodontis* sp. nov. — 4. Entire worm, ventral view (NSMT-PI 4974, holotype). 5. Terminal genitalia, ventral view. 6. Ovarian complex, ventral view. A, acetabulum; CS, cirrus sac; E, eggs in uterus; G, genital pore; L, Laurer's canal; M, metraterm; MG, Mehlis' gland; O, ovary; SR, seminal receptacle; V, vitelline duct (omitted).

0.62. Sucker ratio 1 : 1.6–1.7. Forebody 50–53% of body length.

Testes longitudinally elongated oval, symmetrical, touching lateral margin of hindbody, right testis $0.42\text{--}0.63 \times 0.28\text{--}0.41$ and left testis $0.55\text{--}0.69 \times 0.25\text{--}0.31$. Cirrus sac claviform, arcuate, $1.02\text{--}1.19 \times 0.23\text{--}0.26$, terminating posteriorly at anterior border of acetabulum or occasionally a little beyond it, containing bipartite seminal vesicle, long tubular prostatic vesicle $0.41\text{--}0.72$ long, prostatic cells and eversible cirrus. Genital pore at or near sinistral margin of body, at level of midway between suckers.

Ovary spherical, $0.28\text{--}0.32 \times 0.30\text{--}0.32$, usually median, in contact with posterior border of acetabulum. Seminal receptacle $0.15\text{--}0.40 \times 0.20\text{--}0.28$, just posterior to ovary. Laurer's canal opening dorsally, posterosinistral to ovary. Vitelline follicles large, in two lateral groups, 8–10 on right, 9–12 on left, lining almost longitudinally from pharyngeal or bifurcal level to near or slightly beyond anterior border of acetabulum. Uterus filling hindbody and anterolateral space of acetabulum. Metraterm well-developed, $0.29\text{--}0.43$ long, surrounded by glandular cells. Eggs $35\text{--}41 \times 17\text{--}21 \mu\text{m}$. Excretory pore terminal; anterior extent of vesicle obscured by numerous eggs in uterus.

Remarks. According to Bray (1987), the subgenus *Spinoderetrema* of the genus *Deretrema* contains five species. The present new species is most similar to *D. (S.) acutum* Pritchard, 1963 in having an elongated body, cirrus sac extending the acetabulum, and vitellaria in distinctly two lateral groups. However, differences are observed in that *D. (S.) acutum* has caeca reaching past the testes, uterus in the hindbody, inconspicuous metraterm, and vitellaria in clustered masses.

Lepocreadiidae

13. *Bianium hemistoma* (Ozaki, 1928)

Material. From intestine of *Stephanolepis cirrhifer* (Monacanthidae), Fukaura, Ehime Prefecture, Japan, 25–V–1972 (NSMT-PI 1013); intestine of *S. cirrhifer*, Fukaura, 17–XII–1972 (NSMT-PI 1120); intestine of *Takifugu porphyreus* (Tetraodontidae), Tsushima, Nagasaki Prefecture, Japan, 17–VII–1973 (NSMT-PI 1537); and intestine of *T. xanthopterus*, Takojima, Ishikawa Prefecture, Japan, 27–IX–1984 (NSMT-PI 2983).

Remarks. Largest specimen from *Takifugu xanthopterus* is 2.5 long by 1.5 wide.

14. *Dermadena spatiosa* Bray & Cribb, 1996

Material. Ten specimens from intestine of *Aluterus scriptus* (Monacanthidae), Ogasawara, Japan, 9–VII–1976 (NSMT-PI 2007).

Description. Based on 10 specimens. Body transversely elongated, 1.63–2.53 long by 1.97–2.78 wide. Width 110–145% of length. Tegument spinose. Ventral surface with 60 or more dome-shaped glandular pores. Oral sucker 0.14–0.27×0.18–0.32. Prepharynx very short. Pharynx 0.10–0.18×0.18–0.28. Intestinal bifurcation much nearer oral sucker than acetabulum. Acetabulum 0.19–0.30×0.23–0.33. Sucker ratio 1 : 1.0–1.3. Forebody 38–53% of body length.

Testes oval with slightly irregular surface, symmetrical, in anterior hindbody; right testis 0.29–0.54×0.18–0.39 and left testis 0.38–0.59×0.30–0.40. Cirrus sac claviform, 0.68–1.07×0.20–0.34, extending posteriorly midacetabular level or more anteriorly, containing subglobular seminal vesicle, oval to elongated pars prostatica, and long ejaculatory duct. Genital pore sinistral to pharynx.

Ovary ovoid, 0.13–0.26×0.16–0.31, intertesticular. Seminal receptacle usually posterosinistral to acetabulum. Laurer's canal opening dorsally just or near posterosinistral to ovary. Uterus descending posterior to ovary before extending anteriorly. Metraterm thick-walled, nearly the same as long as cirrus sac. Eggs 76–90×51–62 μm . Vitellaria follicular surrounding caeca from pharyngeal level to caecal termination and confluent posteriorly. Excretory pore dorsal, between caecal terminations; vesicle extending near midovarian level.

Remarks. This species was initially described by Bray and Cribb (1996b) from

Cantheschenia grandisquamis (Monacanthidae) from the Great Barrier Reef, Australia. According to them, this species is characterized by being wider than long (body width 125 to 140% of the length), having no conspicuous field of glandular cells around the cirrus sac and metraterm, a genital pore at the pharyngeal level, an entire ovary, no anterior marginal notch, and larger eggs (egg length 82–99 μm). Our specimens agree fairly well with the original description except that some glandular cells are observed around the cirrus sac and metraterm.

15. *Diploproctodaeum hakofugu* Shimazu, 1989

Material. From intestine of *Ostracion cubicus* (Ostraciidae), Nago, Okinawa Prefecture, Japan, 4–VI–1988 (NSMT-PI 3417); and intestine of *O. cubicus*, Nago, 23–V–1992 (NSMT-PI 4281).

16. *Diploproctodaeum haustum* (MacCallum, 1918)

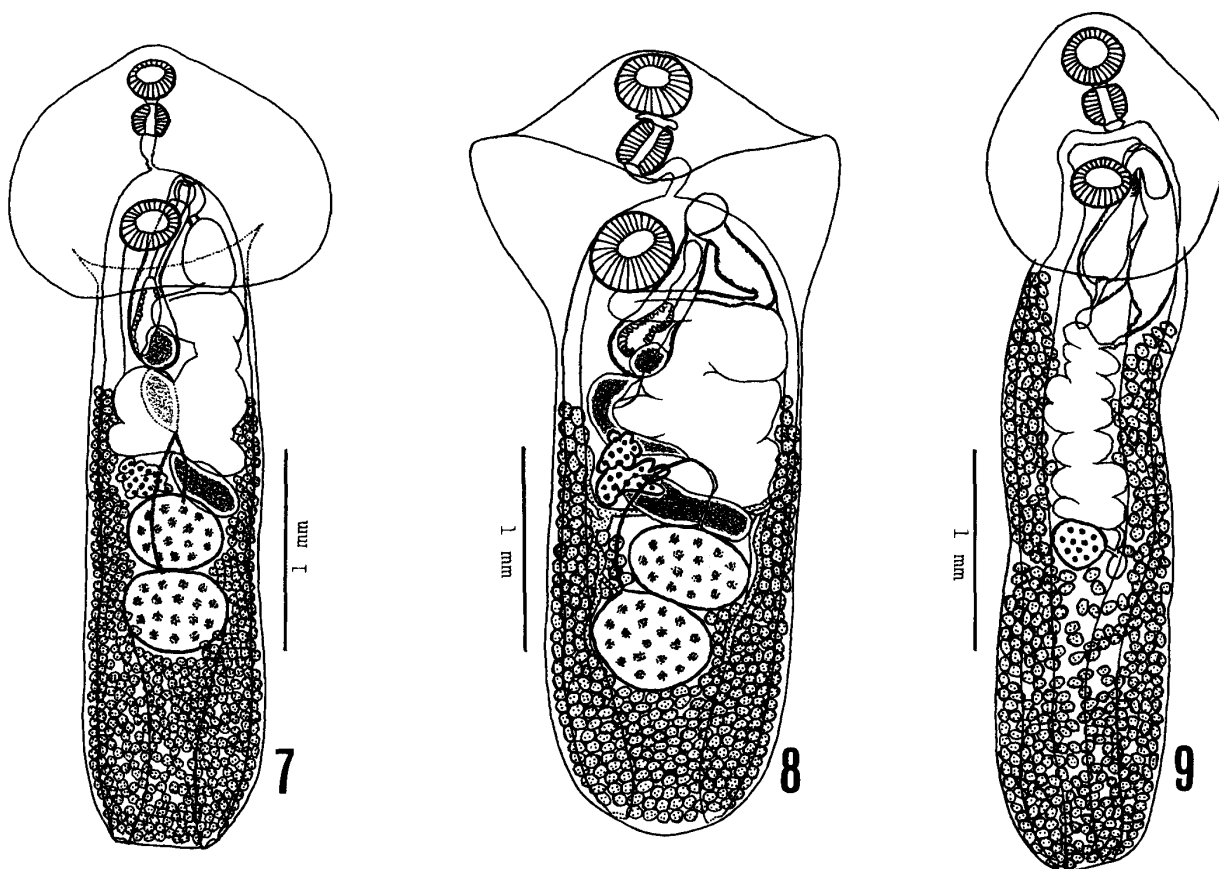
(Figs. 7–9)

Material. Two specimens from intestine of *Aluterus monoceros* (Monacanthidae), Fukaura, Ehime Prefecture, Japan, 21–V–1972 (NSMT-PI 965b); 8 specimens from intestine of *A. scriptus*, Ogasawara, Japan, 9–VII–1967 (NSMT-PI 2005); 6 specimens from intestine of *A. scriptus*, Nago, Okinawa Prefecture, Japan, 21–V–1983 (NSMT-PI 2791); and 5 specimens from intestine of *A. scriptus*, Nago, 9–III–1996 (NSMT-PI 4887).

Remarks. Body consisting of ovoid scoop and cylindrical hindbody. Scoop with numerous glandular cells. Tegument usually with fine spines. Caeca terminating close to posterior extremity and forming ani. Acetabulum consistently including in scoop. Testes tandem, contiguous, central to posterior in hindbody. Cirrus sac claviform, extending posteriorly near midway between acetabulum and ovary. Genital pore sinistral, at level of anterior border of acetabulum. Ovary tightly compact, with probably 5–15 irregular-shaped lobes but difficult to count lobes, dextral, usually touching anterior testis. Seminal receptacle sinistral to ovary, full of sperm. Vitellaria commencing at midway between acetabulum and ovary, confluent in posttesticular area. For measurements see Table 1.

Our specimens agree fairly well with the description of *Diploproctodaeum haustum* by Yamaguti (1970) from *Aluterus scriptus* and *Amaneses carolae* (Monacanthidae) from Hawaii except some of our specimens have larger bodies with correspondingly larger organs. Our specimens appear to be indistinguishable from *D. haustum*, overlapping in several characters and measurements, especially in various ratios.

Three specimens from *Aluterus monoceros* (NSMT-PI 965b) are: Body 2.80–3.56 \times 0.57–0.70; width 16–25% of length. Scoop 0.62–0.73 \times 0.90–0.93; 18–26% of body length. Oral sucker 0.17–0.19 \times 0.27–0.28; prepharynx 0.03–0.05 long; pharynx



Figs. 7–9. *Diploproctodaeum haustum* (MacCallum, 1918). — 7. Specimen from *Aluterus scriptus*, ventral view (NSMT-PI 4887). 8. Specimen from *A. monoceros*, ventral view (NSMT-PI 965b, Scoop folded). 9. Malformed specimen without testes from *A. scriptus*, ventral view (NSMT-PI 4887).

0.16–0.18×0.14–0.17; esophagus 0.03–0.06 long. Acetabulum 0.20–0.22×0.25–0.27. Sucker ratio 1:0.9–1.0. Forebody 13–20% of body length. Anterior testis 0.24–0.33×0.28–0.32; posterior testis 0.33–0.43×0.27–0.30. Posttesticular space 14–22% of body length. Cirrus sac 0.58–1.02 long. Ovary 0.13–0.21×0.15–0.23. Eggs 64–71×40–46 μm . Two specimens with small numbers of eggs from *Stephanolepis cirrhifer* (Monacanthidae, NSMT-PI 1120b) are: Body 2.83–3.00×0.47–0.50; width 17% of length. Scoop 0.75–0.78×0.73–0.75; 25–27% of body length. Oral sucker 0.17–0.21×0.23–0.25; prepharynx 0.07–0.08 long; pharynx 0.13–0.14×0.15–0.18; esophagus 0.03–0.06 long. Acetabulum 0.16–0.21×0.22–0.25. Sucker ratio 1:1.0. Forebody 19% of body length. Anterior testis 0.28–0.31×0.29–0.30; posterior testis 0.34–0.36×0.28–0.29. Posttesticular space 15–17% of body length. Cirrus sac 0.70–0.79 long. Ovary 0.11–0.16×0.19–0.22. Eggs 66–72×43–46 μm . These five specimens have no sperm in the seminal receptacle despite the seminal vesicle is full of sperm. Every specimen has a trilobed ovary.

Table 1. Measurements of *Diploproctodaeum haustorium*

Host	<i>Aluterus scriptus</i> <i>Amuses carolae</i>	<i>Aluterus scriptus</i>	<i>Aluterus scriptus</i>	<i>Aluterus scriptus</i>	<i>Aluterus monoceros</i>
Locality	Hawaii	Ogasawara	Okinawa	Okinawa	Ehime
No. of worms measured	7	8	6	5	2
Data source	Yamaguti (1970)	Present authors	Present authors	Present authors	Present authors
Body length (mm)	1.8-2.5	1.53-1.66	2.13-2.88	3.22-4.60	3.43-3.50
Body width	0.4-0.52	0.43-0.57	0.62-0.73	0.84-0.95	1.13-1.15
Width % of length		27-37	22-32	21-27	33
Scoop	0.55-0.8×0.6-0.8	0.46-0.58×0.56-0.71	0.62-0.80×0.65-1.03	0.92-1.35×1.34-1.68	0.95-1.00×1.63-1.73
Scoop % of body length		29-37	28-33	29-34	28-29
Precoral lobe (long)		0.01-0.03	0.02-0.05	0.04-0.07	0.07-0.18
Oral sucker	0.06-0.13×0.08-0.16	0.09-0.13×0.16-0.20	0.12-0.16×0.18-0.22	0.17-0.25×0.20-0.28	0.22-0.26×0.37
Prepharynx (long)	0.03-0.04	0.02-0.03	0.03-0.04	0.03-0.06	0.05-0.06
Pharynx	0.07-0.10×0.08-0.11	0.08-0.12×0.09-0.14	0.12-0.15×0.12-0.17	0.14-0.19×0.15-0.21	0.23-0.24×0.21-0.22
Esophagus (long)	0.05-0.12	0.03-0.08	0.07-0.19	0.11-0.23	0.23-0.38
Acetabulum	0.09-0.18	0.09-0.20×0.13-0.27	0.16-0.21×0.24-0.28	0.21-0.29×0.26-0.33	0.33-0.36×0.39-0.40
Sucker ratio		1:1.1-1.4	1:1.2-1.4	1:1.2-1.4	1:1.0-1.1
Forebody length % of body length		20-30	23-26	21-26	22-25
Anterior testis		0.15-0.23×0.22-0.38	0.23-0.28×0.28-0.33	0.35-0.40×0.41-0.53	0.40-0.45×0.55-0.59
Posterior testis	0.17-0.27×0.11-0.2	0.17-0.21×0.21-0.31	0.26-0.33×0.28-0.34	0.42-0.54×0.45-0.59	0.46-0.54×0.57-0.58
Posttesticular space % of body length		15-23	19-24	20-27	17-19
Cirrus sac (long)	0.25-0.45	0.31-0.49	0.49-0.78	0.67-1.00	0.72-0.76
Ovary	0.09-0.16×0.07-0.13	0.11-0.16×0.11-0.20	0.13-0.20×0.14-0.19	0.20-0.26×0.20-0.30	0.39-0.40×0.33-0.35
Seminal receptacle	0.13-0.23×0.09-0.17	0.06-0.11×0.11-0.17	0.18-0.28×0.13-0.19	0.19-0.21×0.30-0.45	0.17×0.36-0.64
Eggs (μm)	51-63×37-46	58-67×37-42	56-66×38-42	58-69×40-44	64-74×43-51

In addition, three specimens from *Aluterus scriptus* (NSMT-PI 2755) and 1 specimen from *A. scriptus* (NSMT-PI 4887, Fig. 9) are malformed without testes. They are: Body $3.98\text{--}5.40 \times 0.75\text{--}0.93$; width 14–21% of length. Scoop $0.97\text{--}1.20 \times 1.10\text{--}1.45$; 19–30% of body length. Oral sucker $0.24\text{--}0.26 \times 0.28\text{--}0.36$; prepharynx 0.08–0.10 long; pharynx $0.17\text{--}0.22 \times 0.22\text{--}0.26$; esophagus 0.02–0.07 long. Acetabulum $0.25\text{--}0.31 \times 0.29\text{--}0.37$. Sucker ratio 1 : 1.0. Forebody 16–18% of body length. Testes lacking; cirrus sac 0.55–1.08 long. Ovary $0.26\text{--}0.30 \times 0.24\text{--}0.28$, with even or slightly uneven surface, not lobate. Eggs $63\text{--}69 \times 41\text{--}51\text{ }\mu\text{m}$.

17. *Hypocreadium cavum* Bray & Cribb, 1996

Material. Three specimens from intestine of *Psuedobalistes flavimarginatus* (Balistidae), Palau, 11–VII–1980 (NSMT-PI 2458).

Remarks. Our specimens are: Body 2.18–2.33 long by 2.20–2.35 wide, with a notch at anteromedian margin. Width 98–101% of length. Oral sucker $0.15\text{--}0.17 \times 0.18\text{--}0.20$. Pharynx $0.11 \times 0.13\text{--}0.15$. Acetabulum $0.25\text{--}0.27 \times 0.26\text{--}0.28$. Sucker ratio 1 : 1.34–1.42. Forebody 45–49% of body length. Testes $0.28\text{--}0.35 \times 0.25\text{--}0.30$. Cirrus sac $0.60\text{--}0.62 \times 0.20\text{--}0.24$. Genital pore at bifurcal level. Ovary $0.16\text{--}0.18 \times 0.26\text{--}0.30$, with the anterior border at posttesticular level. Uterus preovarian. Partially collapsed eggs $66\text{--}84 \times 43\text{--}54\text{ }\mu\text{m}$.

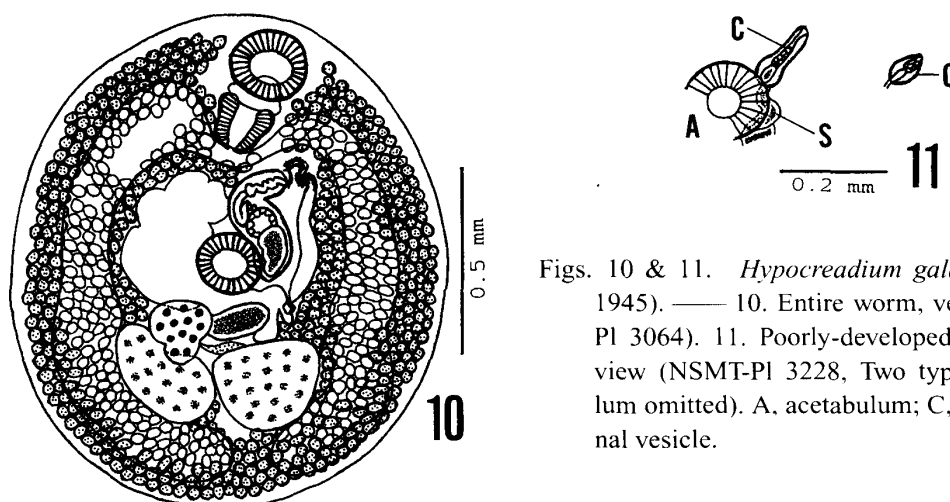
This species was originally described by Bray and Cribb (1996b) from *Abalistes stellatus* and *Cantheschenia grandisquamis* from the Great Barrier Reef, Australia. Our specimens agree fairly well with their description. In their description, however, the acetabulum is smaller (sucker ratio 1 : 1.18–1.32), ovary intertesticular and the eggs smaller ($64\text{--}70 \times 30\text{--}35\text{ }\mu\text{m}$ or $67\text{--}68 \times 45\text{ }\mu\text{m}$). Our specimens do not have massive gland cells around the terminal genitalia.

18. *Hypocreadium galapagoense* (Manter, 1945)

(Figs. 10–11)

Material. Three specimens from intestine of *Odonus niger* (Balistidae), Koniya, Kagoshima Prefecture, Japan, 19–XI–1985 (NSMT-PI 3210); and 5 specimens from intestine of *O. niger*, Koniya, 21–XI–1985 (NSMT-PI 3228).

Remarks. Three specimens (NSMT-PI 3210) are: Body 1.00–1.34 long by 0.81–1.13 wide. Width 80–84% of length. Tegument with fine spines. Oral sucker $0.15\text{--}0.18 \times 0.15\text{--}0.20$. Pharynx $0.12\text{--}0.13 \times 0.12\text{--}0.16$. Caeca voluminous. Acetabulum $0.12\text{--}0.17 \times 0.12\text{--}0.18$. Sucker ratio 1 : 0.8–0.9. Forebody 49–50% of body length. Testes $0.24\text{--}0.35 \times 0.21\text{--}0.29$, with smooth surface. Posttesticular space 10–18% of body length. Cirrus sac $0.23\text{--}0.38 \times 0.10\text{--}0.13$, extending posteriorly at pre- or near mid-acetabular level. Genital pore sinistral, at bifurcal level, just inside of left caecum. Ovary $0.13\text{--}0.18 \times 0.15\text{--}0.21$, sometimes with one or two incisions. Seminal re-



Figs. 10 & 11. *Hypocreadium galapagoense* (Manter, 1945). — 10. Entire worm, ventral view (NSMT-PI 3064). 11. Poorly-developed cirrus sac, ventral view (NSMT-PI 3228, Two types. Right: acetabulum omitted). A, acetabulum; C, cirrus sac; S, seminal vesicle.

ceptacle $0.09\text{--}0.13 \times 0.18\text{--}0.23$. Uterus pretesticular. Metraterm left to cirrus sac, nearly as long as cirrus sac, with well-developed circular muscle in the distal portion. Eggs $53\text{--}62 \times 35\text{--}41\ \mu\text{m}$. Vitelline follicles filling both sides of body from oral sucker to posterior extremity, confluent dorsally between pharynx and acetabulum, and dorso-ventrally posterior to testes.

This species was initially described by Manter (1945) from *Balistes verres* from the Galapagos Islands. Our specimens slightly differ from his description. In his specimens, the caeca are not voluminous, sucker ratio $1 : 1\text{--}1.13$, the testes lobed, and the eggs $60\text{--}65$ by $33\text{--}34\ \mu\text{m}$.

Additional five specimens (NSMT-PI 3228) are: Body $0.82\text{--}1.16$ long by $0.72\text{--}0.90$ wide. Width $77\text{--}92\%$ of length. Oral sucker $0.10\text{--}0.13 \times 0.14\text{--}0.21$. Pharynx $0.08\text{--}0.12 \times 0.09\text{--}0.18$. Caeca voluminous. Acetabulum $0.13\text{--}0.20 \times 0.12\text{--}0.23$. Sucker ratio $1 : 0.8\text{--}1.1$. Forebody $47\text{--}53\%$ of body length. Testes $0.20\text{--}0.27 \times 0.11\text{--}0.19$, with smooth surface. Posttesticular space $8\text{--}17\%$ of body length. Cirrus sac poorly developed, $0.08\text{--}0.15 \times 0.04\text{--}0.07$; small internal seminal vesicle present but sometimes prostatic vesicle and cirrus not differentiated (Fig. 11). External seminal vesicle convoluted. Ovary $0.12\text{--}0.16 \times 0.11\text{--}0.20$. Seminal receptacle very small or not observed. Eggs $46\text{--}56 \times 28\text{--}34\ \mu\text{m}$.

With the exception of having a poorly developed cirrus sac and a seminal receptacle, and slightly smaller eggs, these five specimens agree with those described above. They may be deformed specimens of *H. galapagoense*.

19. *Hypocreadium patellare* Yamaguti, 1938

Material. One specimen from intestine of *Stephanolepis cirrhiifer* (Monacanthidae), Fukaura, Ehime Prefecture, Japan, 17–XII–1972 (NSMT-PI 1120b); and 4 specimens from intestine of *S. cirrhiifer*, Fukaura, 17–XII–1972 (NSMT-PI 1121).

Remarks. Four specimens (NSMT-PI 1121) are: Body 1.43–1.58 long by 1.58–1.83 wide. Width 105–116% of length. Oral sucker 0.10–0.13×0.14–0.17. Pharynx 0.07–0.09×0.09–0.12. Caeca slightly undulating. Acetabulum 0.18–0.19×0.17–0.22. Sucker ratio 1:1.17–1.28. Forebody 41–47% of body length. Testes 0.25–0.39×0.22–0.28. Cirrus sac 0.40–0.48×0.17–0.21, containing seminal vesicle, bipartite prostatic vesicle and convoluted cirrus. Genital pore at bifurcal level. Ovary 0.23–0.26×0.17–0.20, usually with even, occasionally uneven surface. Eggs 66–71×43–47 μm .

Yamaguti (1938) described this species from *Monacanthus cirrhifer* from Japan. Later, Manter (1940) described *H. scaphosomum* from *Balistes polylepis* and *B. varres* from Galapagos Islands. *H. scaphosomum* is quite similar to *H. patellare*. Manter (1940) gave five distinguishing features; caeca, prostatic vesicle, cirrus, ovary and eggs. In the undulating caeca and the convoluted cirrus, our specimens are like *H. scaphosomum*, but in the egg size, they are like *H. patellare*. In the prostatic vesicle, Yamaguti (1938) incorrectly stated that *H. patellare* had a short recurved prostatic vesicle. Our reexamination of type specimens of *H. patellare* (MPM Coll. No. 22861) revealed the prostatic vesicle to be bipartite which is the same structure as that of *H. scaphosomum*.

A single specimen from another individual of *Stephanolepis cirrhifer* (NSMT-PI 1120b) is: Body 1.73 long by 2.08 wide. Width 120% of length. Oral sucker 0.17×0.18. Pharynx 0.10×0.16. Caeca hardly undulating. Acetabulum 0.22×0.23. Sucker ratio 1:1.25. Forebody 45% of body length. Testes 0.30–0.35×0.29–0.30. Cirrus sac 0.40×0.15. Cirrus S-shaped. Genital pore at postpharyngeal level. Ovary 0.25×0.20, with even surface. Eggs a few in number, 66×43–46 μm .

The caeca and the cirrus of this specimen are intermediate features between *H. patellare* and *H. scaphosomum*. In other respects, this specimen is like *H. patellare*. Consequently the only difference between the two species seems to be egg size, being 63–81 by 33–43 μm for *H. patellare* and 51–56 (occasionally up to 66) by 32–44 (occasionally 26) μm for *H. scaphosomum*. We place our specimens from *Stephanolepis cirrhifer* in *H. patellare*.

20. *Lepotrema clavatum* Ozaki, 1932

Material. Three specimens from intestine of *Thamnaconus modestus* (Monacanthidae), Fukaura, Ehime Prefecture, Japan, 27–V–1972 (NSMT-PI 1014); and 5 specimens from intestine of *Odonus niger* (Balistidae), Koniya, Kagoshima Prefecture, Japan, 21–XI–1985 (NSMT-PI 3228a).

Remarks. Slightly macerated specimens from *Thamnaconus modestus* are large (2.1–2.5 long) without eggs.

21. *Lobatocreadium magnum* sp. nov.

(Fig. 12)

Material. Four specimens from intestine of *Arothron hispidus* (Tetraodontidae), Palau, 20–VI–1980 (NSMT-PI 2327, holotype and 3 paratypes).

Description. Based on 4 specimens. Body oval, 3.00–3.50 long by 1.78–2.18 wide. Tegument sparsely spinose. Oral sucker subglobular, $0.45\text{--}0.54 \times 0.62\text{--}0.73$. Preoral lobe 0.07–0.09 long. Prepharynx 0.10–0.12 long. Pharynx bowl-shaped, well-developed, almost as large as oral sucker, $0.34\text{--}0.48 \times 0.63\text{--}0.76$, with eight anterior wavy lined projections. Esophagus short, 0.05–0.07 long. Caeca arcuate, terminating close to posterior extremity. Acetabulum spherical, $0.63\text{--}0.75 \times 0.66\text{--}0.78$. Sucker ratio 1 : 0.97–1.06. Forebody 58–60% of body length.

Testes obliquely tandem, overlapping partially; anterior testis $0.31\text{--}0.37 \times 0.63\text{--}0.75$, slightly dextral; posterior testis $0.47\text{--}0.50 \times 0.50\text{--}0.68$, close to posterior extremity. Posttesticular space lacking. Cirrus sac claviform, $0.50\text{--}0.64 \times 0.24\text{--}0.27$, terminating posteriorly at anterior border of acetabulum; containing oval, incised seminal vesicle, tubular prostatic vesicle, and eversible cirrus with fine spines. External seminal vesicle oval to elongated, 0.18–0.53 long, extending around right of acetabulum to pre- or postacetabular level. Genital pore slightly sinistral, midway between intestinal bifurcation and acetabulum, much nearer bifurcal.

Ovary consisting of nearly 30 small lobes, $0.25\text{--}0.32 \times 0.49\text{--}0.57$ as a whole, forming a cluster, not divided into two lateral fields, between acetabulum and anterior testis. Seminal receptacle $0.16\text{--}0.28 \times 0.35\text{--}0.65$, sinistral or posterosinistral to ovary. Laurer's canal opening mid-dorsally near posterior level of seminal receptacle. Uterus between acetabulum and testes, and sinistral to acetabulum; metraterm $2/3$ as long as cirrus sac. Eggs $63\text{--}72 \times 43\text{--}51\ \mu\text{m}$. Vitelline follicles extending from middle or posterior level of oral sucker to posterior extremity, slightly confluent in bifurcal region and dorsal to testes. Excretory vesicle not observed.

Remarks. According to Bray and Cribb (1996b), the genus *Lobatocreadium* contains five species. The present new species is most like *L. exiguum* (Manter, 1963), but differs from it by having larger body, larger pharynx almost as large as the oral sucker, caeca ending close to the posterior extremity, and ovary consisting of nearly 30 lobes. In the original description of *L. exiguum*, the body is small measuring 0.938 to 1.036 by 0.622 to 0.728, the oral sucker 0.161 to 0.200 wide, the pharynx 0.100 to 0.115 by 0.129 to 0.145, the caeca ending at the posterior edge of the posterior testis, and the ovary consisting of 7 lobes.

22. *Lobatocreadium ryukyuense* sp. nov.

(Fig. 13)

Material. Three specimens from intestine of *Ostracion cubicus* (Ostraciidae),

Nago, Okinawa Prefecture, Japan, 23-V-1992 (NSMT-PI 4282b, holotype and 2 paratypes).

Description. Based on 3 specimens. Body elongated, 0.84–1.08 long by 0.34–0.49 wide. Tegument spinose. Oral sucker cup-shaped, subterminal, $0.22\text{--}0.31 \times 0.29\text{--}0.39$; prepharynx 0.06–0.11 long; pharynx subglobular, $0.21\text{--}0.28 \times 0.23\text{--}0.36$, with eight anterior wave-like projections; esophagus 0.10–0.14 long; caeca terminating close to posterior extremity. Acetabulum spherical, $0.20\text{--}0.25 \times 0.22\text{--}0.26$. Sucker ratio 1 : 0.64–0.76. Forebody 40–42% of body length.

Testes irregular in outline, sometimes with incisions, tandem or obliquely tandem, contiguous, intercaecal, in posterior half of hindbody; anterior testis $0.25\text{--}0.38 \times 0.35\text{--}0.41$ and posterior testis $0.27\text{--}0.45 \times 0.39\text{--}0.46$. Posttesticular space 9–15% of body length. Cirrus sac claviform, $0.46\text{--}0.52 \times 0.11\text{--}0.14$, left of acetabulum, extending to slightly beyond posterior border of acetabulum; containing oval seminal vesicle, tubular prostatic vesicle, and eversible cirrus. External seminal vesicle elongated oval, $0.22\text{--}0.32 \times 0.10\text{--}0.12$, sometimes sinuous, reaching midway between acetabulum and anterior testis. Genital pore sinistral, overlapping left caecum, at bifurcal level.

Ovary composed of nearly 20 lobes, $0.15\text{--}0.25 \times 0.35\text{--}0.37$ as a whole, forming a cluster, dextral, pretesticular. Seminal receptacle saccular, $0.31\text{--}0.37 \times 0.13\text{--}0.18$, sinistral to ovary. Laurer's canal long, opening mid-dorsally at posterior border of an-

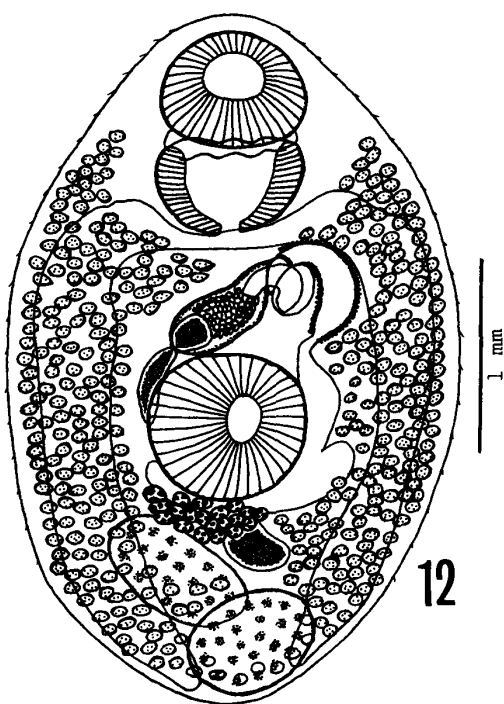


Fig. 12. *Lobatocreadium magnum* sp. nov., ventral view (NSMT-PI 2327, holotype).

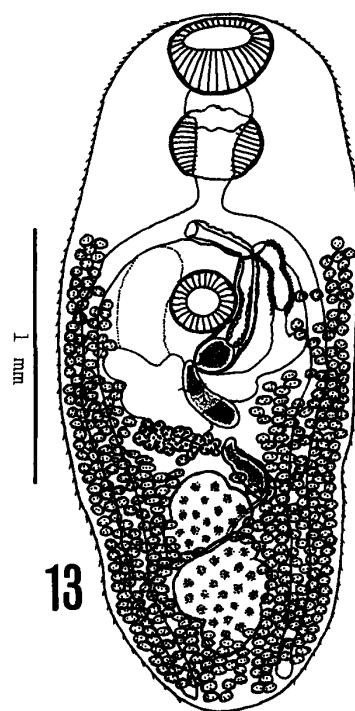


Fig. 13. *Lobatocreadium ryukyuense* sp. nov., ventral view (NSMT-PI 4282, holotype).

terior testis. Uterus between acetabulum and ovary; metraterm $1/2$ to $2/3$ as long as cirrus sac, surrounded by glandular cells, between cirrus sac and left caecum. Eggs $58-66 \times 40-44 \mu\text{m}$. Vitelline follicles from bifurcal level to posterior extremity, confluent in posttesticular region. Excretory pore subdorsal; vesicle tubular, extending around right of acetabulum to slightly anterior to acetabulum.

Remarks. Though the present new species is like the members of the genus *Lepocreadium*, we place it in the genus *Lobatocreadium* because of possessing an acinous ovary. The present new species is similar to *L. balistes* Hussain, Rao & Shyamasundari, 1986 from *Balistes stellaris* from India in having an elongated body and both cirrus sac and metraterm on the left side of the acetabulum, but differs from it in that the latter has suckers of nearly the same size, a medially located genital pore, a cirrus sac not extending beyond the posterior border of the acetabulum, etc. In *L. exiguum*, the type species of the genus, Manter (1963) stated the excretory vesicle to cover the posterior testis dorsally, whereas Yamaguti (1970) mentioned it to reach beyond the anterior border of the acetabulum, which is the same as the present new species. The excretory system was not given in the description of *L. balistes*.

23. *Pseudocreadium monacanthi* Layman, 1930

Material. From intestine of *Thamnaconus modestus* (Monacanthidae), Tushima, Nagasaki Prefecture, Japan, 16-VII-1973 (NSMT-PI 1535); and intestine of *T. modestus*, Takojima, Ishikawa Prefecture, Japan, 12-V-1986 (NSMT-PI 3264).

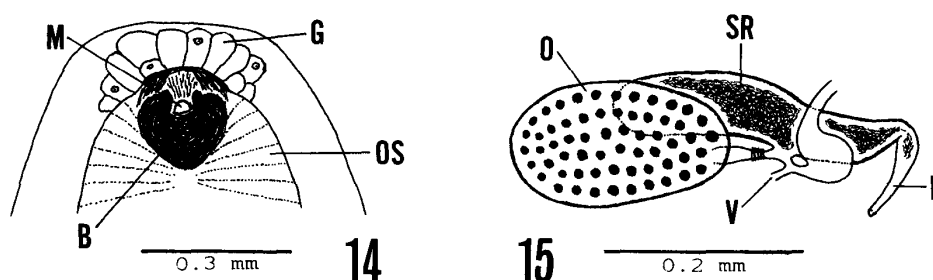
Remarks. In our specimens, the testes have uneven surface and the metraterm is provided with circular muscle distally. Our largest specimen is: Body 3.03×2.13 . Oral sucker 0.35×0.34 . Pharynx 0.27×0.21 . Acetabulum 0.42×0.44 . Sucker ratio 1:1.29. Forebody 50% of body length. Testes $0.48-0.55 \times 0.31-0.33$. Cirrus sac 0.42×0.21 . Ovary acinous, 0.26×0.44 as a whole. Collapsed eggs $66-74 \times 45-49 \mu\text{m}$.

24. *Sphincteristomum acollum* Oshmarin, Mamaev & Parukhin, 1961

(Figs. 14-15)

Material. From intestine of *Balistoides viridescens* (Balistidae), Nago, Okinawa Prefecture, Japan, 8-VI-1991 (NSMT-PI 4179); intestine of *Pseudobalistes fuscus*, Nago, 28-V-1992 (NSMT-PI 4307); intestine of *P. fuscus*, Nago, 11-III-1996 (NSMT-PI 4894); intestine of *B. viridescens*, Nago, 13-III-1996 (NSMT-PI 4913); and intestine of *B. viridescens*, Nago, 3-XII-1996 (NSMT-PI 4998).

Remarks. Our seven specimens from *Balistes viridescens* (NSMT-PI 4179) are: Body 2.77-3.45 long by 1.00-1.18 wide. Oral sucker $0.39-0.50 \times 0.39-0.48$. Mouth surrounded by V-shaped muscular bundle ventrolaterally and elongated glandular cells dorsally (Fig. 14). Prepharynx 0.04-0.07 long. Pharynx $0.10-0.11 \times 0.20-0.27$.



Figs. 14 & 15. *Sphincteristomum acollum* Oshmarin, Mamaev & Parukhin, 1916. — 14. Anterior extremity, ventral view. 15. Ovarian complex, ventral view. B, muscular bundle; G, glandular cell; L, Laurer's canal; M, mouth; O, ovary; OS, oral sucker; SR, seminal receptacle; V, vitelline duct (omitted).

Esophagus 0.01–0.03 long. Acetabulum 0.18–0.21×0.19–0.22. Sucker ratio 1:0.4–0.5. Forebody 27–29% of body length. Anterior testis 0.23–0.35×0.46–0.56. Posterior testis 0.27–0.41×0.38–0.51. Posttesticular space 38–46% of body length. Ovary 0.10–0.14×0.21–0.28. Seminal receptacle partially overlapping ovary dorsosinistrally. Laurer's canal opening anterosinistral to anterior testis (Fig. 15). A small number of eggs (2–10) in uterus. Collapsed eggs 61–67×40–49 μm .

Schistorchiidae

Neomegacreadium gen. nov.

Schistorchiidae. Body thin, linguiform, unspined. Oral sucker large, with muscular broad pad antero-dorsally. Mouth surrounded by muscular bundle latero-posteriorly. Prepharynx very short. Pharynx globular. Esophagus lacking. Caeca ending in a uroproct near middle of posttesticular region. Acetabulum small, about one-third of body length from anterior extremity. Testes 10, occasionally 11 or 12 in number, in two longitudinal rows, intercaecal, mainly in middle third of body. Cirrus sac absent. Seminal vesicle sacculate. Genital pore immediately preacetabular. Ovary dextral, pretesticular. Seminal receptacle and Laurer's canal present. Uterus compact, sinistral, pretesticular. Vitelline follicles small, extending from near posterior level of oral sucker to posterior extremity, confluent in posttesticular region. Excretory vesicle I-shaped, terminating in anterior zone of testes. Intestinal parasites of marine teleosts.

Type species: *Neomegacreadium okinawanum* sp. nov.

25. *Neomegacreadium okinawanum* sp. nov.

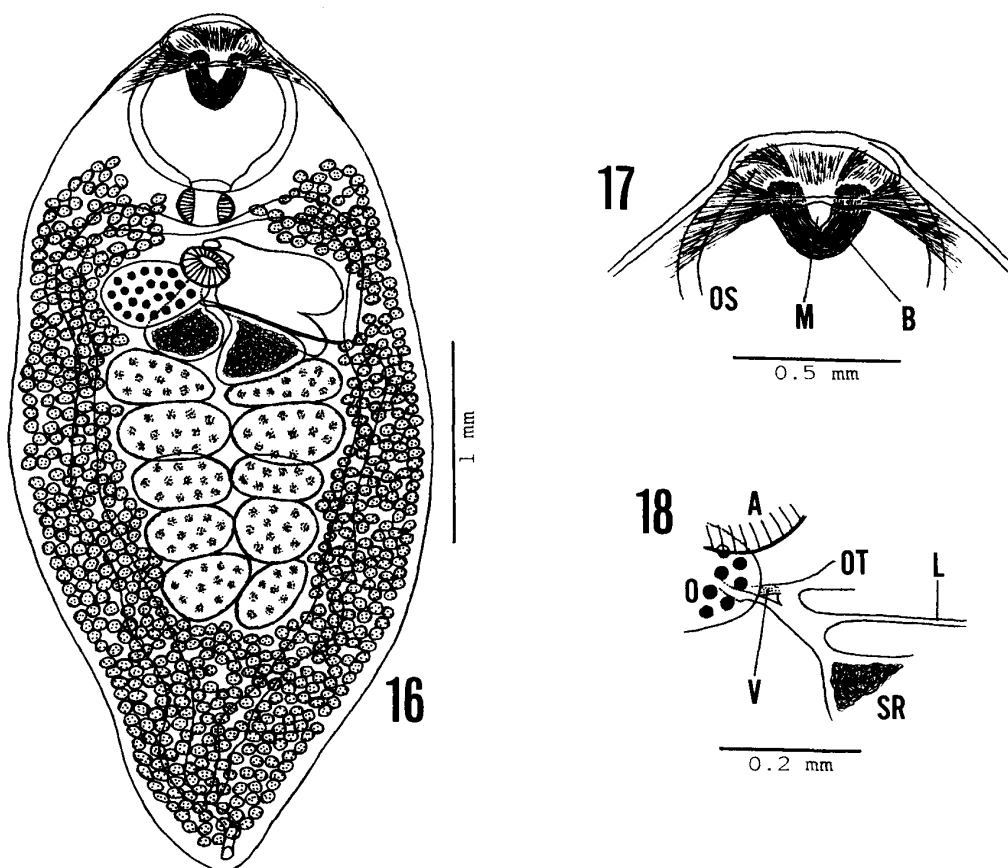
(Figs. 16–18)

Material. Seven specimens from intestine of *Triodon macropterus* (Triodontidae), Nago, Okinawa Prefecture, Japan, 28–XI–1996 (NSMT-PI 4973, holotype and 6 paratypes).

Description. Based on 7 specimens. Body thin, linguiform with round anterior and tapering posterior extremities, 3.37–4.18 long by 1.42–1.95 wide. Tegument smooth. Oral sucker large, $0.51\text{--}0.65 \times 0.64\text{--}0.76$, with anterior muscular broad pad $0.15\text{--}0.27 \times 0.41\text{--}0.52$. Mouth surrounded by U-shaped muscular bundle latero-posteriorly. Prepharynx very short, up to 0.05 long. Pharynx globular, $0.16\text{--}0.20 \times 0.23\text{--}0.30$. Esophagus absent. Caeca extending to middle or more posterior of posttesticular region, joining excretory vesicle to form uoproct with ventral pore near posterior extremity. In a specimen, a transverse bridge between caeca was observed just posterior to testes before forming a uoproct. Acetabulum small, $0.17\text{--}0.20 \times 0.19\text{--}0.23$. Sucker ratio 1 : 0.3. Forebody 26–28% of body length.

Testes 10, occasionally 11 or 12 in number, each subglobular, in two longitudinal rows, intercaecal, mainly in middle third of body. Cirrus sac absent. Seminal vesicle sacculate, extending around right or dorsal of acetabulum to front margin of anteriormost testis. Genital pore immediately anterior to acetabulum.

Ovary subglobular, slightly wider than long, $0.27\text{--}0.34 \times 0.39\text{--}0.58$, dextral, be-



Figs. 16–18. *Neomegacreadium okinawanum* gen. & sp. nov. — 16. Entire worm, ventral view (NSMT-PI 4973, holotype). 17. Anterior extremity, ventral view. 18. Ovarian complex, ventral view. A, acetabulum; B, muscular bundle; L, Laurer's canal; M, mouth; O, ovary; OS, oral sucker; OT, ootype; SR, seminal receptacle; V, vitelline duct (omitted).

tween acetabulum and testes. Seminal receptacle $0.10\text{--}0.41 \times 0.27\text{--}0.45$, size variable depending on sperm storage, sinistral to ovary. Laurer's canal running transversely to left caecum and opening dorsally at postovarian level. Uterus compact, left to mid-line, extending from postbifurcal to anterotesticular level. Partially collapsed eggs $59\text{--}71 \times 40\text{--}50\text{ }\mu\text{m}$. Vitelline follicles small, extending from near posterior level of oral sucker to posterior end of body, confluent in posttesticular region. Excretory vesicle I-shaped, terminating in anterior zone of testes.

Remarks. Nagaty (1956) erected the genus *Megacreadium* to accommodate a single species, *M. tetrodontis* Nagaty, 1956, which was based on a single specimen from *Tetrodon* sp. from the Red Sea. There appears to be no records of this species afterward.

The genus *Megacreadium* is characterized by having a mouth surrounded by three circumoral lobes, two lateral and one posterior; two ani; eight testes; vitellaria extending anteriorly to the postovarian level; and enormous eggs measuring 140 by $90\text{ }\mu\text{m}$.

The present new genus resembles *Megacreadium* in having circumoral lobe, but the former has a mouth enclosed by a broad lobe anteriorly and well-developed muscular bundle posterolaterally. Some other differences are observed between the two genera: the present genus has a uroproct, ten or occasionally 11 or 12 testes, vitellaria extending to the posterior level of the oral sucker, and normal sized eggs 59 to 71 by 40 to $50\text{ }\mu\text{m}$.

Lecithasteridae

26. *Aponurus laguncula* Looss, 1907

Material. From stomach of *Aluterus monoceros* (Monacanthidae), Fukaura, Ehime Prefecture, Japan, 20-V-1972 (NSMT-PI 949); stomach of *A. monoceros*, Fukaura, 21-V-1972 (NSMT-PI 964); stomach of *A. monoceros*, Fukaura, 24-V-1972 (NSMT-PI 996); stomach of *Stephanolepis cirrhifer* (Monacanthidae), Fukaura, 27-V-1972 (NSMT-PI 1012); and stomach of *A. monoceros*, Takojima, Ishikawa Prefecture, Japan, 5-X-1984 (NSMT-PI 3032).

Remarks. Two species of *Aponurus*, *A. vitellograndis* Layman, 1930 and *A. rhinoplagusiae* Yamaguti, 1934, have been reported from tetraodontiform fishes from Japanese waters.

A. vitellograndis is $1.688\text{--}1.720$ (Layman, 1930) or 1.570 long (Yamaguti, 1934) and has seminal receptacle 0.16×0.11 (Yamaguti, 1934) and eggs $27\text{--}32 \times 10\text{--}16\text{ }\mu\text{m}$ (Layman, 1930). Layman did not compare with any other species in his description. *A. vitellograndis* closely resembles *A. laguncula*, but the former has slightly larger body and slightly smaller egg width than those of the latter.

A. rhinoplagusiae is $1.79\text{--}2.36$ long and has seminal receptacle $0.33\text{--}0.42 \times 0.27\text{--}0.3$ and eggs $29\text{--}34 \times 11\text{--}15\text{ }\mu\text{m}$ (Yamaguti, 1934). Yamaguti distinguished this

species by its enormous seminal receptacle.

Our smallest specimen from *Aluterus monoceros* (NSMT-PI 3032) is: Body 1.60×0.63 . Oral sucker 0.09×0.15 . Pharynx 0.06×0.07 . Acetabulum 0.25×0.27 . Sucker ratio 1 : 1.8. Forebody 28% of body length. Anterior testis 0.20×0.31 . Posterior testis 0.18×0.28 . Seminal vesicle 0.23×0.11 . Hermaphroditic sac 0.13×0.10 . Ovary 0.17×0.28 . Postovarian space 30% of body length. Seminal receptacle 0.24×0.30 . Eggs $26\text{--}30 \times 15\text{--}18 \mu\text{m}$. This specimen is almost similar to *A. vitellograndis* in body size, but the seminal receptacle is intermediate between value for *A. vitellograndis* and *A. rhinoplagusiae*.

Our largest specimen from *Aluterus monoceros* (NSMT-PI 949) is: Body 3.28×0.90 . Oral sucker 0.19×0.21 . Pharynx 0.10×0.11 . Acetabulum 0.41×0.37 . Sucker ratio 1 : 1.8. Forebody 33% of body length. Anterior testis 0.31×0.30 . Posterior testis 0.32×0.28 . Seminal vesicle 0.36×0.25 . Hermaphroditic sac 0.23×0.13 . Ovary 0.32×0.21 . Postovarian space 28% of body length. Seminal receptacle 0.52×0.57 . Eggs $30\text{--}34 \times 11\text{--}15 \mu\text{m}$. This specimen is larger than *A. rhinoplagusiae* in body and organs including seminal receptacle.

Our only specimen from *Stephanolepis cirrhifer* (NSMT-PI 1012) is: Body 1.95×0.71 . Oral sucker 0.13×0.17 . Pharynx 0.07×0.09 . Acetabulum 0.31×0.34 . Sucker ratio 1 : 2.0. Forebody 27% of body length. Anterior testis 0.22×0.31 . Posterior testis 0.20×0.30 . Seminal vesicle 0.25×0.19 . Hermaphroditic sac 0.13×0.08 . Ovary 0.22×0.31 . Post ovarian space 31% of body length. Seminal receptacle 0.16×0.24 . Eggs $26\text{--}30 \times 12\text{--}16 \mu\text{m}$. This specimen resembles *A. rhinoplagusiae* in body size, but is rather near *A. vitellograndis* in size of seminal receptacle.

There is much overlap of characteristics and measurements among *A. laguncula*, *A. rhinoplagusiae*, *A. vitellograndis* and our specimens. The worms successively increase in body size in order of *A. laguncula*, *A. vitellograndis*, *A. rhinoplagusiae* and our present specimens. Their egg sizes are overlapping with each other. The size of seminal receptacle varies depending on sperm storage. This character cannot be valid for separating species. *A. laguncula* is euryxenic, with no dominant host group (Bray & MacKenzie, 1990), and therefore has considerable variation in characteristics and measurements. We consider *A. vitellograndis* and *A. rhinoplagusiae* synonymous with *A. laguncula*.

Sclerodistomidae

27. *Prosorchiopsis aluterae* Yamaguti, 1970

Material. From stomach of *Aluterus monoceros* (Monacanthidae), Fukaura, Ehime Prefecture, Japan, 20-V-1972 (NSMT-PI 950); stomach of *A. monoceros*, Fukaura, 24-V-1972 (NSMT-PI 989); stomach of *A. monoceros*, Fukaura, 17-XII-1972 (NSMT-PI 1119); stomach of *A. monoceros*, Fukaura, 19-XII-1972 (NSMT-PI 1138); and stomach of *A. scriptus*, Nago, Okinawa Prefecture, Japan, 27-V-1992

(NSMT-PI 4300).

28. *Prosogonotrema bilabiatum* P. Vigueras, 1940

Material. From stomach of *Aluterus monoceros* (Monacanthidae), Tanegashima, Kagoshima Prefecture, Japan, 9–XI–1974 (NSMT-PI 1687).

References

- Bray, R. A., 1984. Some helminth parasites of marine fishes and cephalopods of South Africa: Aspidogastrea and digenean families Bucephalidae, Haplospilichnidae, Mesometridae and Fellodistomidae. *J. Nat. Hist.*, **18**: 271–292.
- Bray, R. A., 1987. A revision of the family Zoogonidae Odhner, 1902 (Platyhelminthes: Digenea): subfamily Lepidophyllinae and comments on some aspects of biology. *Syst. Parasitol.*, **9**: 83–123.
- Bray, R. A. & T. H. Cribb, 1996a. Two *Lepotrema* Ozaki, 1932 species (Digenea: Lepocreadiidae) from marine fishes from the southern Great Barrier Reef, Australia. *Syst. Parasitol.*, **35**: 111–117.
- Bray, R. A. & T. H. Cribb, 1996b. The Australian species of *Lobatocreadium* Madhavi, 1972, *Hypocreadium* Ozaki, 1936 and *Dermadena* Manter, 1945 (Digenea: Lepocreadiidae), parasites of marine tetraodontiform fishes. *Syst. Parasitol.*, **35**: 217–236.
- Bray, R. A., T. H. Cribb & S. C. Barker, 1996. Diploproctodaeinae (Digenea: Lepocreadiidae) from the coastal fishes of Queensland, Australia, with a review of the subfamily. *J. Nat. Hist.*, **30**: 317–366.
- Bray, R. A. & K. MacKenzie, 1990. *Aponurus laguncula* Looss, 1907 (Digenea: Lecithasteridae): a report from herring, *Clupea harengus* L., in the eastern English channel and a review of its biology. *Syst. Parasitol.*, **17**: 115–124.
- Hanson, M. L., 1955. Some digenetic trematodes of plectognath fishes of Hawaii. *Proc. Helminthol. Soc. Wash.*, **22**: 75–87.
- Hussain, S. A., K. H. Rao & K. Shyamasundari, 1986. On three new digenetic trematodes and *Hypocreadium indicum* comb. nov., of the family: Lepocreadiidae (Odhner, 1905) Nicoll, 1935 from marine fishes of Waltair coast (Bay of Bengal). *Rev. Ibér. Parasitol.*, **46**: 141–147.
- Kamegai, Sh., 1970. *Plectognathotrema* (*Alloplectognathotrema*) *tsushimaense* n. subg., n. sp. (Trematoda: Cephaloporidae, Plectognathotrematinae n. subfam.), from intestine of marine fish, *Navodon modestus*. *Res. Bull. Meguro Parasit. Mus.*, (3): 5–11.
- Layman, E. M., 1930. Parasitic worms from the fishes of Peter the Great Bay. *Bull. Pacific Sci. Fish. Res. Sta.*, **3**: 1–120. (In Russian and German)
- Machida, M., 1971. Fellodistomid trematodes from marine fishes near the Tsushima Islands in the Sea of Japan. *Bull. Natn. Sci. Mus., Tokyo, Ser. A*, **14**: 187–193.
- Machida, M., 1972. A new digenetic trematode, *Paradiscogaster aluteri* (Fellodistomidae), from the leatherjacket, *Aluterus monoceros* in Japan. *Jpn. J. Parasitol.*, **21**: 446–448.
- Machida, M., 1980. Hemiurid trematodes of *Kyphosus* collected around Cape Shionomisaki, Kii Peninsula. *Mem. Natn. Sci. Mus., Tokyo*, (13): 113–120.
- Machida, M., 1993. Trematodes from kyphosid fishes in Japanese and adjacent waters. *Bull. Natn. Sci. Mus., Tokyo, Ser. A*, **19**: 27–36.
- Machida, M., 1996. Digenean trematodes from mullets in Japanese and adjacent waters. *Jpn. J. Parasitol.*, **45**: 123–133.
- Machida, M. & A. Uchida, 1990. Trematodes from unicornfishes of Japanese and adjacent waters. *Mem. Natn. Sci. Mus., Tokyo*, (23): 69–81.
- Manter, H. W., 1940. Digenetic trematodes of fishes from the Galapagos Islands and the neighboring Pa-

- cific. *Allan Hancock Pacific Exped.*, **2**: 329–497.
- Manter, H. W., 1945. *Dermadena lactophrysi* n. gen., n. sp. (Trematoda: Lepocreadiidae) and consideration of the related genus *Pseudocreadium*. *J. Parasitol.*, **31**: 411–417.
- Manter, H. W., 1963. Studies on digenetic trematodes of fishes of Fiji. II. Families Lepocreadiidae, Opistholebetidae, and Opecoelidae. *J. Parasitol.*, **49**, 99–113.
- Manter, H. W. & M. H. Pritchard, 1962. Studies on digenetic trematodes of Hawaiian fishes: Families Fellodistomatidae, Opistholebetidae and Gyliuchenidae. *Trans. Am. Micros. Soc.*, **81**: 113–123.
- Nagaty, H. F., 1956. Trematodes of fishes from the Red Sea. Part 6. On five distomes including one new genus and four new species. *J. Parasitol.*, **42**: 151–155.
- Oshmarin, P. G., Y. L. Mamaev & A. M. Parukhin, 1961. New species of trematodes of the family Diploproctodaeidae Ozaki, 1928. *Helminthologia*, **3**: 254–260. (In Russian)
- Ozaki, Y., 1928. On some trematodes with anus. *Jpn. J. Zool.*, **2**: 5–33.
- Ozaki, Y., 1932. A new trematode from file-fish: *Lepotrema clavatum* n. g. n. sp. *Proc. Imp. Acad. Jap.*, **8**: 44–47.
- Ozaki, Y., 1935. Two new trematodes of the family Opistholebetidae Travassos. *Proc. Imp. Acad. Jap.*, **11**: 244–246.
- Ozaki, Y., 1937. Studies on the trematode Families Gyliuchenidae and Opistholebetidae, with special reference to lymph system. II. *J. Sci. Hirosima Univ., Ser. B, Div. 1*, **5**: 167–244.
- Pritchard, M. H., 1963. Studies on digenetic trematodes of Hawaiian fishes, primarily families Lepocreadiidae and Zoogonidae. *J. Parasitol.*, **49**: 578–587.
- Shimazu, T., 1989. Two new species of the genus *Diploproctodaeum* (Trematoda: Lepocreadiidae: Diploproctodaeinae), with some comments on species in the subfamily Diploproctodaeinae, from Japanese marine fishes. *Zool. Sci.*, **6**: 579–588.
- Skrjabin, K. I. & V. P. Koval, 1957. Family Fellodistomatidae Nicoll, 1913. In Trematodes of Animals and Man, **13**: 163–452. (In Russian)
- Stunkard, H. W., 1978. The life-cycle and taxonomic relations of *Lintonium vibex* (Linton, 1900) Stunkard and Nigrelli, 1930 (Trematoda: Fellodistomidae). *Biol. Bull.*, **155**: 383–394.
- Yamaguti, S., 1934. Studies on the helminth fauna of Japan. Part 2. Trematodes of fishes, I. *Jpn. J. Zool.*, **5**: 249–541.
- Yamaguti, S., 1938. Studies on the helminth fauna of Japan. Part 21. Trematodes of fishes, IV. Publ. by author. 139 pp, 1 pl.
- Yamaguti, S., 1959. Studies on the helminth fauna of Japan. Part 54. Trematodes of fishes, XIII. *Publ. Seto Mar. Biol. Lab.*, **7**: 241–262, pls. XX–XXI.
- Yamaguti, S., 1970. Digenetic Trematodes of Hawaiian Fishes. 436 pp. Keigaku Publ., Tokyo.
- Yamaguti, S., 1971. Synopsis of Digenetic Trematodes of Vertebrates. 1074 pp, 349 pls. Keigaku Publ., Tokyo.